

# Claims

- [c1] 1. A method for detecting a tie-up in an automatic transmission having at least an input shaft and an output shaft, the method comprising:  
determining a rate of change of acceleration of a transmission shaft;  
comparing the rate of change of acceleration of the transmission shaft to a predetermined value; and  
indicating a tie-up when the rate of change of acceleration of the transmission shaft is below the predetermined value.
- [c2] 2. The method of claim 1, wherein determining the rate of change of acceleration of the transmission shaft includes determining a speed of the transmission shaft and twice differentiating the determined speed with respect to time.
- [c3] 3. The method of claim 1, further comprising:  
inducing a tie-up in the transmission;  
determining the rate of change of acceleration of the transmission shaft throughout the induced tie-up; and  
setting the predetermined value based on the determined rate of change of acceleration of the transmission

shaft throughout the induced tie-up.

- [c4] 4. The method of claim 1, further comprising:  
determining when the transmission is in a shift cycle;  
and  
preventing the indication of a tie-up unless the transmission is in a shift cycle.
- [c5] 5. The method of claim 4, wherein the shift cycle is divided into a plurality of shift phases, including a boost phase and a stroke phase, and wherein the indication of a tie-up is prevented unless the transmission is in a boost phase or a stroke phase.
- [c6] 6. A method for detecting tie-up in an automatic transmission having at least an input shaft and an output shaft, the method comprising:  
monitoring a speed of a transmission shaft for some period of time;  
calculating a parameter related to the speed of the transmission shaft, the parameter having a plurality of time dependent values;  
comparing at least some of the parameter values to a predetermined value;  
determining each time the at least some parameter values change from being at or above the predetermined value to being below the predetermined value;

temporarily preventing indication of a tie-up when the at least some parameter values change from being at or above the predetermined value to being below the predetermined value with a frequency that equals or exceeds a predetermined frequency; and indicating a tie-up when the at least some parameter values change from being at or above the predetermined value to being below the predetermined value and indication of a tie-up is not prevented.

[c7] 7. The method of claim 6, wherein the parameter is a rate of change of acceleration of the transmission shaft.

[c8] 8. The method of claim 7, wherein calculating the parameter includes twice differentiating with respect to time the transmission shaft speed.

[c9] 9. The method of claim 6, further comprising:  
inducing a tie-up in the transmission;  
calculating the parameter throughout the induced tie-up; and  
setting the predetermined value based on the parameter calculated throughout the induced tie-up.

[c10] 10. The method of claim 6, further comprising:  
determining when the transmission is in a shift cycle;  
and

preventing the indication of a tie-up unless the transmission is in a shift cycle.

- [c11] 11. The method of claim 10, wherein the shift cycle is divided into a plurality of shift phases, including a boost phase and a stroke phase, and wherein the indication of a tie-up is prevented unless the transmission is in a boost phase or a stroke phase.
- [c12] 12. The method of claim 6, wherein temporarily preventing indication of a tie-up includes setting a first flag, the method further comprising clearing the first flag, thereby allowing indication of a tie-up, when a first predetermined amount of time passes after the first flag is set and the at least some parameter values do not change from being at or above the predetermined value to being below the predetermined value before the first predetermined amount of time passes.
- [c13] 13. The method of claim 12, wherein the first predetermined amount of time includes first and second time segments, the first time segment being based on the amount of time the at least some parameter values remain below the predetermined value after the at least some parameter values change from being at or above the predetermined value to being below the predetermined value, the second time segment beginning when

the at least some parameter values change from being below the predetermined value to being at or above the predetermined value, and the second time segment ending after a second predetermined amount of time.

- [c14] 14. A vehicle having a driveline including a transmission with at least an input shaft and an output shaft, the vehicle comprising:
- a controller in communication with the transmission and configured to
- a) monitor a speed of a transmission shaft for some period of time,
  - b) calculate a parameter related to the transmission shaft speed, the parameter having a plurality of time dependent values,
  - c) compare at least some of the parameter values to a predetermined value,
  - d) determine each time the at least some parameter values change from being at or above the predetermined value to being below the predetermined value,
  - e) temporarily prevent indication of a tie-up when the at least some parameter values change from being at or above the predetermined value to being below the predetermined value with a frequency that equals or exceeds a predetermined frequency, and
  - f) indicate a tie-up when the at least some parameter

values change from being at or above the predetermined value to being below the predetermined value and indication of a tie-up is not prevented.

- [c15] 15. The vehicle of claim 14, wherein the parameter is a rate of change of acceleration of the transmission shaft.
- [c16] 16. The vehicle of claim 15, wherein the controller is further configured to twice differentiate with respect to time the transmission shaft speed, thereby calculating the rate of change of acceleration of the transmission shaft.
- [c17] 17. The vehicle of claim 14, wherein the predetermined value is set based on behavior of the parameter during an induced tie-up.
- [c18] 18. The vehicle of claim 14, wherein the predetermined value is set based on a known frequency of the driveline.
- [c19] 19. The vehicle of claim 14, wherein the controller is further configured to determine when the transmission is in a shift cycle, and to prevent the indication of a tie-up unless the transmission is in a shift cycle.
- [c20] 20. The vehicle of claim 19, wherein the shift cycle is divided into a plurality of shift phases, including a boost phase and a stroke phase, and wherein the controller is

further configured to prevent indication of a tie-up unless the transmission is in a boost phase or a stroke phase.

[c21] 21. The vehicle of claim 14, wherein the controller temporarily prevents indication of a tie-up by setting a first flag, the controller being further configured to clear the first flag, thereby allowing indication of a tie-up, when a first predetermined amount of time passes after the first flag is set and the at least some parameter values do not change from being at or above the predetermined value to being below the predetermined value before the first predetermined amount of time passes.

[c22] 22. The vehicle of claim 21, wherein the first predetermined amount of time includes first and second time segments, the first time segment being based on the amount of time the at least some parameter values remain below the predetermined value after the at least some parameter values change from being at or above the predetermined value to being below the predetermined value, the second time segment beginning when the at least some parameter values change from being below the predetermined value to being at or above the predetermined value, and the second time segment ending after a second predetermined amount of time.